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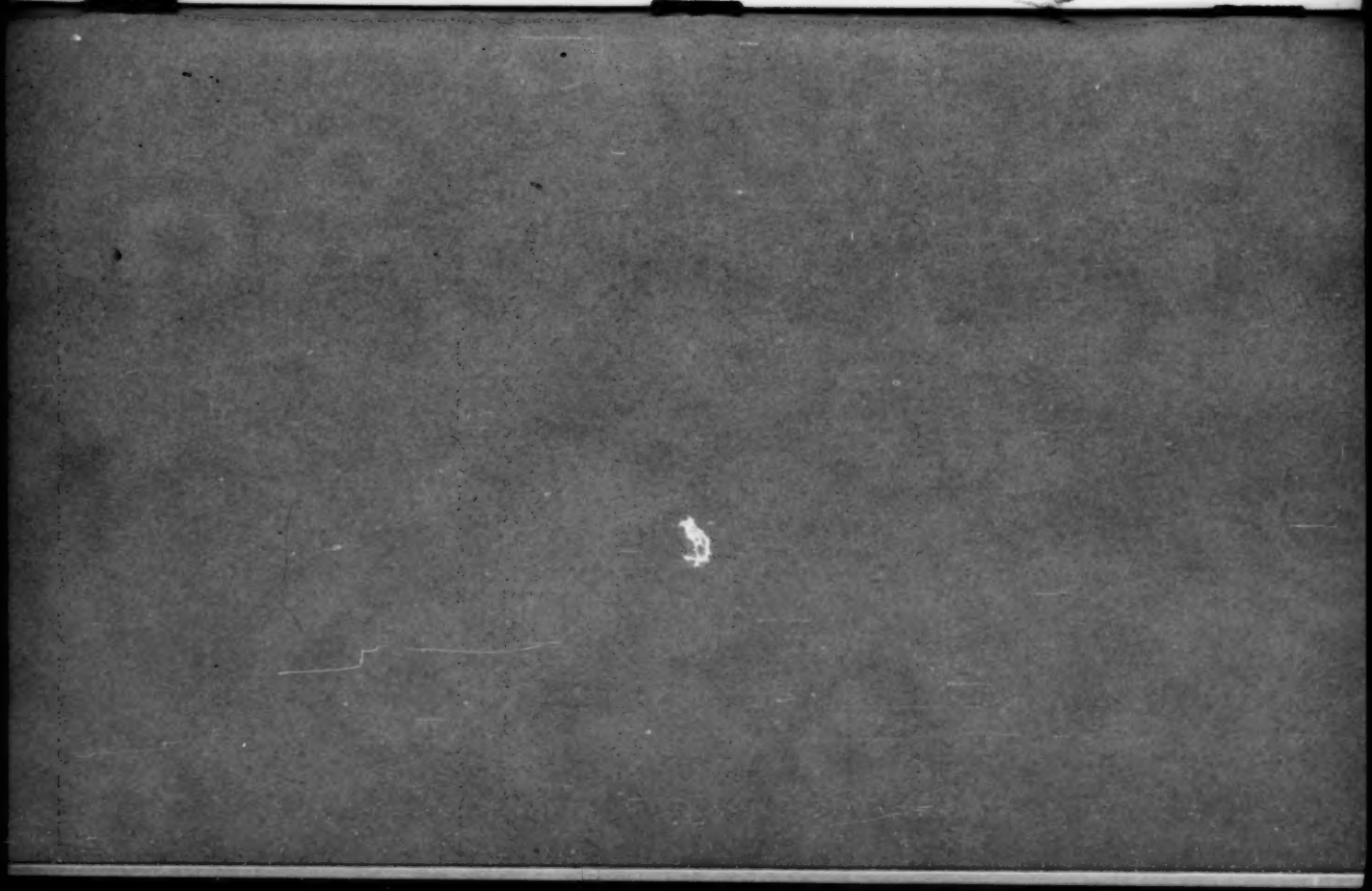
BUSH TERMINAL BUILDING
130 WEST 42nd STREET, NEW YORK



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Overhead During Low-Volume Production

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Publication Department Note

Mr. A. F. Stock, who has collaborated with Mr. J. M. Coffey in the writing of this article is too well known to our membership to need an introduction. He has been active in the affairs of the New York Chapter and has appeared on the program at the annual meetings of the N. A. C. A. and has talked before many of the local chapters. With Mr. M. B. Gordon he is co-author of our Official Publication, No. 9, Volume IV, entitled *Prices, Profits and Production.*

Mr. Stock has had a wide experience in the industrial field having served his apprenticeship in the employ of several large American industries, thus receiving a knowledge of all the operating departments. Mr. Coffey's experience has duplicated Mr. Stock's in most respects. Both men served as members of the staff of a large industrial engineering organization where they handled production, costs, and organization work. At the time of writing this article they were in charge of the Industrial Department of Lybrand, Ross Bros. & Montgomery in the New York office. Quite recently Mr. Stock has gone as Controller to the Manhattan Shirt Co.

OVERHEAD DURING LOW-VOLUME PRODUCTION

It is generally considered that the conditions prevailing in many industries will cause manufacturers to operate considerably below their customary capacity during the next few years. The increased factory facilities acquired during the war period, and the slackened demand of the European trade have given rise to a situation which merits very careful study.

Cost accounting must consider and stress the selling viewpoint because it is evident that if this over-supply of factory equipment is to be utilized and if plants are to operate somewhere near normal, customer buying must be stimulated effectively. This stimulation may take the form of new products appealing to the public, or it may mean the production of greater quantities of the same product at reduced and more attractive prices. When the selling price meets the consumer's viewpoint of value at a given moment, it cannot help but stimulate sales. Future business will never be forthcoming to make use of idle equipment unless sales prices anticipate future costs. During low volume conditions, the sales department wants lower prices. Costs for estimating purposes, therefore, cannot be based on present actual conditions, but must anticipate the future conditions, in order to attract new business.

This article is written to bring out the factors that should be considered in aiding the selling division to increase the sales volume. The basis suggested is not a "cure-all." Obviously, no basis will work during the low ebb of industry when depression

exists and when the laws of supply and demand preclude sales at any reasonable price.

It is certain, however, that under present conditions lower prices have stimulated buying. No one can measure the amount of business that is lost to industry at this time because prices are not attractive to the consumer. There are articles (not articles of necessity) which consumers would buy if price were low enough. The real problem is to determine how far costs can be reduced in this effort to obtain a sufficient volume of business.

Cost accounting should provide the sales executive with information showing how cost will vary with increases in the sales volume. The selling department problem is to reduce prices sufficiently to attract volume necessary to operate the factory upon an economical basis. The selling branch relies upon the cost department for estimates of the costs of probable future orders. The cost accountant is continually facing the question "how much will ten thousand articles, X-100, cost in the future if we land the order?" This means a studied revision of factory expenses with the future conditions in mind. The cost accountant must necessarily consider the volume factor and he must reconstruct his actual cost figures so as to provide the selling division with sound estimates. The cost accountant must know his actual costs thoroughly and he must exercise keen and far-sighted judgment in ascertaining the effect of increases in production upon such costs.

The cost accountant should continue his normal overhead rates all through his inventory valuations and in his provision for profit and loss and balance sheet purposes. The suggested overhead calculations referred to hereinafter, are purely statistical. They are not tied in with the books. They are designed principally to aid the selling division in fixing prices for desired quantities.

It is with the above general conditions in mind and based on some of their experiences of the last few years, that the authors put forth the following suggestions in connection with handling this situation so far as it relates to cost accounting.

This article is written as a sequel to the topic presented in Official Publication No. 9, Volume 4, and gives more of the detailed departmental workings which go to make up the general situation discussed in the former publication. Official Publication No. 9, Volume 4, entitled "Prices, Profits and Production," issued January 15, 1923, gave the broad principles for the cost accountant to consider in attempting to attract a sufficient volume of business to reach what may be termed the "breaking line or point of profit." It should be stressed again that this is the correct general basis on which to obtain sufficient future business in any enterprise to bring it somewhere near its capacity point. This former discussion of the subject was rather general and somewhat brief, confining itself to broad underlying principles. It could not be applied in full to a plant having numerous departments and manufacturing a great variety of products. Such conditions demand a

separate study of each department because each department's fixed expense is related to the products going through it.

It is assumed for the purpose of this article that the policy of distributing factory overhead by departments is very well defined and established. There are few cost accountants today who do not accept this principle as standard practice. It is also generally established that departmental overhead rates, whether they be machine hour rates, labor hour rates or percentage on labor dollars, are nearly all based on normal operating conditions. However, there is no accepted formula for determining normal operating conditions. The authors have found in their recent experiences that few cost accountants agree on the method or basis of establishing a normal operating capacity. Some consider normal as 85 or 90 per cent of theoretical capacity, while others reduce theoretical capacity to practical capacity by deducting allowances for special purpose machines, for workmen absent a certain percentage of their time, etc. This question of practical capacity versus theoretical capacity has been very ably presented in a former Official Publication, Volume 3, No. 19, issued July 1, 1922, entitled "Normal Burden Rates."

Probably most cost men consider a normal rate simply an average of actual overhead. After all, there is a great deal to be said in favor of this definition. If a business for the past year or two years has operated profitably on a certain basis, this might well be considered a fair normal. The establishment of normal overhead rates by departments, however, presents a very difficult problem, which must be solved by each plant according to the conditions existing there.

The establishment of some standard of predetermined departmental overhead is highly recommended for any type of industry. This is necessary: (1) to prevent unwarranted fluctuations in actual costs during periods of low or peak production, (2) to avoid the inflation of inventory values during periods of depression, and (3) to enable the quick compilation of a monthly profit and loss statement. It is assumed in this article that some standard basis of departmental burden calculation has been established whether it is called normal, standard, predetermined or by some similar name. In addition to the calculation of normal overhead and the showing in each month's profit and loss statement of an over- or under-absorbed overhead, and in addition to the overhead used on the costing of orders, it is suggested that, in order to aid the selling division, the cost accountant set up certain memorandum statistics based on the *actual departmental overhead.* Assuming, of course, that the actual overhead expenses are as low as currently possible, it is the present condition which the sales department is striving to better.

The exhibit on page 6 illustrates how the actual burden cost for a three-month period in some department of a typical manufacturing plant may serve as a basis for estimates of future costs under improved production conditions. The usual indirect

labor, the maintenance and repair, and supply items are shown and also the relative portions of such expenses as power, insurance, taxes, depreciation and general factory expense. With the actual burden condition as a basis for the quarter period an attempt to estimate the future on various bases should be made. In the case illustrated, an increase in volume of 25 per cent has been assumed and the direct labor hours which have been used as the basis for measuring the overhead costs have been increased accordingly. In other words, the question of whether this department is operating at a greater or less volume would be answered by the number of workmen and the hours they apply.

DEP'T. 1 BURDEN COST ACCOUNT

Standing Ord. No.	*Description*		*Increase 25%*	*Increase 50%*
	Labor			
1-1	Foremen and Assistants	1,200	1,200	1,200
1-2	Clerical Expense	450	450	450
1-3	Inspection	550	600	630
1-4	Idle Time	150	200	240
1-5	Work a/c Shop Error	250	300	340
1-6	Trucking	420	530	600
1-7	Sick and Accident Exp.	200	250	300
1-8	General Labor	225	275	325
	Total	3,445	3,805	4,085
	Maintenance			
1-15	Buildings	500	540	560
1-16	Machinery	1,200	1,300	1,350
1-17	Fixtures	125	135	145
1-18	Tools	2,100	2,400	2,500
1-19	Electrical Apparatus	400	420	440
1-20	Pipe and Power Lines	300	320	340
1-21	Other Equipment	350	370	390
	Total	4,975	5,485	5,725
	Supplies			
1-30	Oils and Waste	40	45	55
1-31	Emery Wheels	60	70	80
1-32	Small Tools	70	85	95
1-33	Miscellaneous	60	70	80
	Total	230	270	310
	Apportioned			
	Proportion of: Power Expense	2,310	2,440	2,480
	General Expense*	2,780	3,475	4,170
	Insurance	800	800	800
	Taxes	700	700	700
	Depreciation	2,800	2,800	2,800
	Total	9,390	10,215	10,950
	Total Burden	18,040	19,775	21,070
	No. Direct Labor Hours	13,900	17,375	20,850
	Actual Rate Per Hour	1.30	1.13	1.02

*At standard rate of 20c. per hour.

The cost accountant should attempt to estimate the conditions that will exist in the future if the department experiences a 25 per cent increase in volume. He should examine in detail each and every item of the departmental burden, and develop a new burden rate on the assumed future condition. For example, the foremen and clerical expense would remain constant regardless of this increase of 25 per cent. The inspection expense would increase but not directly in proportion to the increase in volume. It might increase 10 per cent with a 25 per cent greater volume. Each item of overhead must be studied from this viewpoint, and the reconstructed burden should be divided by the increased number of direct labor hours.

It will be noticed that while the actual burden for the quarter ending March 31, shown upon the accompanying exhibit, was $18,040, the recalculated burden on the basis of a 25 per cent increase in output was $19,775. In the former case the burden was divided by the actual number of direct labor hours and a resulting burden rate of $1.30 per hour obtained. Upon the new estimated basis the burden of $19,775 was divided by the increased number of hours, and the resulting burden rate was found to be $1.13 per hour. A similar calculation, on the basis of a 50 per cent increase in volume over the existing actual volume, results in a burden rate of $1.02 per labor hour. This exhibit merely illustrates the typical statistical data needed properly to forecast departmental overhead rates on a basis of greater output. This plan may be used with equal effectiveness to indicate the results accruing from an increase of output amounting to 10 per cent, 30 per cent, 45 per cent, or even 60 per cent or 75 per cent over present actual production schedules. This entire calculation must be based on *present actual* conditions. It should assume no normal point. Future operating plans should be made on actual experience. The projection of the actual into the future gives the cost man a clear conception of the probable results under improved conditions. In other words, if the selling department is expected to bring in a 25% increase in volume, then the cost figures should reflect the departmental overhead based on that 25% increase and each cost estimated should receive the benefit that is to be derived from the estimated increased production. The effect of this increase should be projected into the cost figures used in the estimate and sales prices should be computed in accordance therewith.

Of course, it is conceded that where the present actual operations are far below a reasonable normal this plan will be of little or no value. Burden rate obtained by calculating at 25% increase would be useless. Under such conditions price cutting has gone so far that the prevailing prices bear practically no relation to actual manufacturing costs, as there is an almost entire lack of demand for the product.

It should be understood that the basis of calculation proposed merely acts as an aid to the cost accountant in judging the effect

of increased sales upon profits. In this connection he should consider normal, actual, maximum and estimated percentages. Normal and actual overhead rates are insufficient in themselves, but with these in mind and with the indicated reductions in departmental rates before him for increases in volume of 10%, 25%, 50%, 60%, respectively, the cost accountant will be in a strong position to give sound opinions upon future operating conditions. No one in the entire operating organization should be better fitted to predict future manufacturing costs and profit.

There is nothing more important than the policy of getting enough business to fill up the plant. Opportunity certainly exists today for the cost accountant to be a real and important factor in the establishment of executive policies which will accomplish beneficial results.

It should be remembered that this calculation should be made for each and every department burden account, as the articles of one department will not go through another. If the departmental basis of burden is justified then it automatically justifies the recalculation of the departmental burden on the basis of predicted increases in volume. These statistical statements by departments will aid in determining whether this increase at lower selling prices will bring more total profits than would actual conditions.

Furthermore an extension of these statements, so as to picture the effect of a sweeping general reduction in selling prices upon a whole industry, serves a very important use. It may be found that prevailing unit price levels could be lowered if by such action sufficient additional volume appeared obtainable to produce a satisfactory profit.

The authors have noted that in most of the industries where an attempt was made to recalculate on the future basis, it was found that the burden generally averaged 75% fixed expense and 25% variable, and the variable was in direct proportion to the increase in sales or anticipated volume. Expressed otherwise, this means that of the total present actual expenses, about 75% will remain fairly constant and 25% will go up, in direct proportion to the sales. These ratios are given merely to make the matter somewhat concrete. They are not presumed to be generally applicable.

Distributing General Factory Expense on a Standard Basis

The preparation of cost statistics upon possible future conditions involves also a careful study of the distribution of general manufacturing expense. Under the most common practice, general manufacturing expense is distributed to producing department overhead accounts on the basis of either the total direct labor hours or the total of the direct and indirect labor hours. Of the two plans the latter is preferred because most items of general factory expense apply equally to indirect and direct workers. It is frequently found also that for ease of accounting, certain work may be classed as indirect and, therefore, this work, under the

direct labor hours method, fails to receive its proper share of the general manufacturing expense.

Conceding that under normal and well balanced operating conditions, general manufacturing expense may be accurately distributed on the basis of total labor hours there still remains the problem of its distribution during periods of subnormal and unbalanced production. The total of such expenses holds fairly constant regardless of the relative activities of the various departments and the distribution of the actual general expense to departments on the total labor hours basis seems unsatisfactory where all departments are not equally busy. The departments with normal or abnormal volumes of work are charged with a disproportionate part of the general factory expense, the costs are distorted, and the comparative value of departmental overhead statements is lost. Referring to the Exhibit illustrating the actual burden and the burden recalculated on the new volume basis, it will be seen that the apportionment of general factory expense is made on a standard basis. In other words, if the general factory or general manufacturing expense statement could be visualized, this statement would show an over- or under-absorbed general factory expense which would not be settled on the operating departments. This feature is a very important one and if intelligent judgment is to be exercised in connection with future operating costs, the question of proper distribution of general expense must be given serious thought.

A method of distributing general manufacturing expense on a standard basis is explained and illustrated below. In most industrial concerns general manufacturing expenses are high. Sometimes they equal or exceed the total of all the other burden charges. They usually include such items as factory executive salaries, factory clerical help—i.e., general help not applicable to definite departments—miscellaneous maintenance charges for the grounds and general buildings, shipping expense, expenses of the cost department, production departments, purchasing department, the general items of taxes and fire insurance, and so forth. Very few factories ever operate for any great length of time at full capacity in all departments. Under present day conditions it is exceptional to find a factory without some departments operating at greatly reduced capacity. However, it is usually necessary to maintain a skeleton organization in each department as there is some productive work being done in all departments. Where such conditions prevail, it is unfair to distribute the entire amount of general manufacturing expense upon the basis of total labor hours because the department operating at normal capacity will be charged with an excessive proportion. The department operating at a greatly reduced rate will be charged with only a very small share and one far below a normal charge. The burden rates of the busy departments will be greatly increased when as a matter of fact such departments should be receiving the benefit of a relatively low rate because of their high operating performances.

It is therefore advocated that general manufacturing expense be distributed upon the basis of a *standard charge per hour or dollar of total pay roll based upon a normal capacity* throughout the plant. This means it is necessary to determine both the normal pay roll, or working hours, for the entire plant and the total normal general manufacturing expense under normal operating conditions. Dividing one by the other gives a standard charge which will absorb general manufacturing expense under normal conditions. In one large factory this procedure resulted in a charge of 20 cents on each dollar of total pay roll in order to cover the normal charge for general manufacturing expense. In another case this charge was 40 cents on each dollar of total pay roll. The charge, in some cases, can be applied on an hourly rather than a dollar basis.

The distribution of general manufacturing expenses upon a standard basis naturally means that there will be an unabsorbed balance of this expense when the factory is operating below capacity for the very reason that general manufacturing expense is largely made up of fixed charges. This unabsorbed or over-absorbed balance, of course, becomes a part of the total unabsorbed or over-absorbed amount for the whole plant.

A separate burden statement should be provided for general manufacturing expense showing all the analytical details. Below the total of this statement or schedule should be shown the distribution of this expense on a standard basis. The balance over- or under-absorbed should then be indicated at the bottom of the page.

The following example is given to illustrate the results of this method of distribution. There is shown the burden statement with the distribution of general manufacturing expense on a standard basis and, in a parallel column is shown a distribution where the entire amount of general manufacturing expense is absorbed. Under the advocated method of distribution the unabsorbed balances appear where they belong and furnish a real guide for managerial purposes. It is only fair that the departmental heads should not be penalized for something beyond their control.

EXAMPLE

The Problem: The actual General Manufacturing Expense in a certain plant is $10,000 per month, the amount remaining constant even when part of the plant operates below normal.

The normal pay roll of all producing departments is $40,000, thus giving 25c per $1 of payroll as the normal rate for distributing General Manufacturing Expense to producing departments.

At a given time, the payroll of the four producing departments is:

Department 1.....	$4,000	
Department 2.....	2,000	
Department 3.....	9,000	
Department 4.....	5,000	$20,000

Payroll of Department 3 is stated to be normal, although the plant as a whole is operating only 50% of normal.

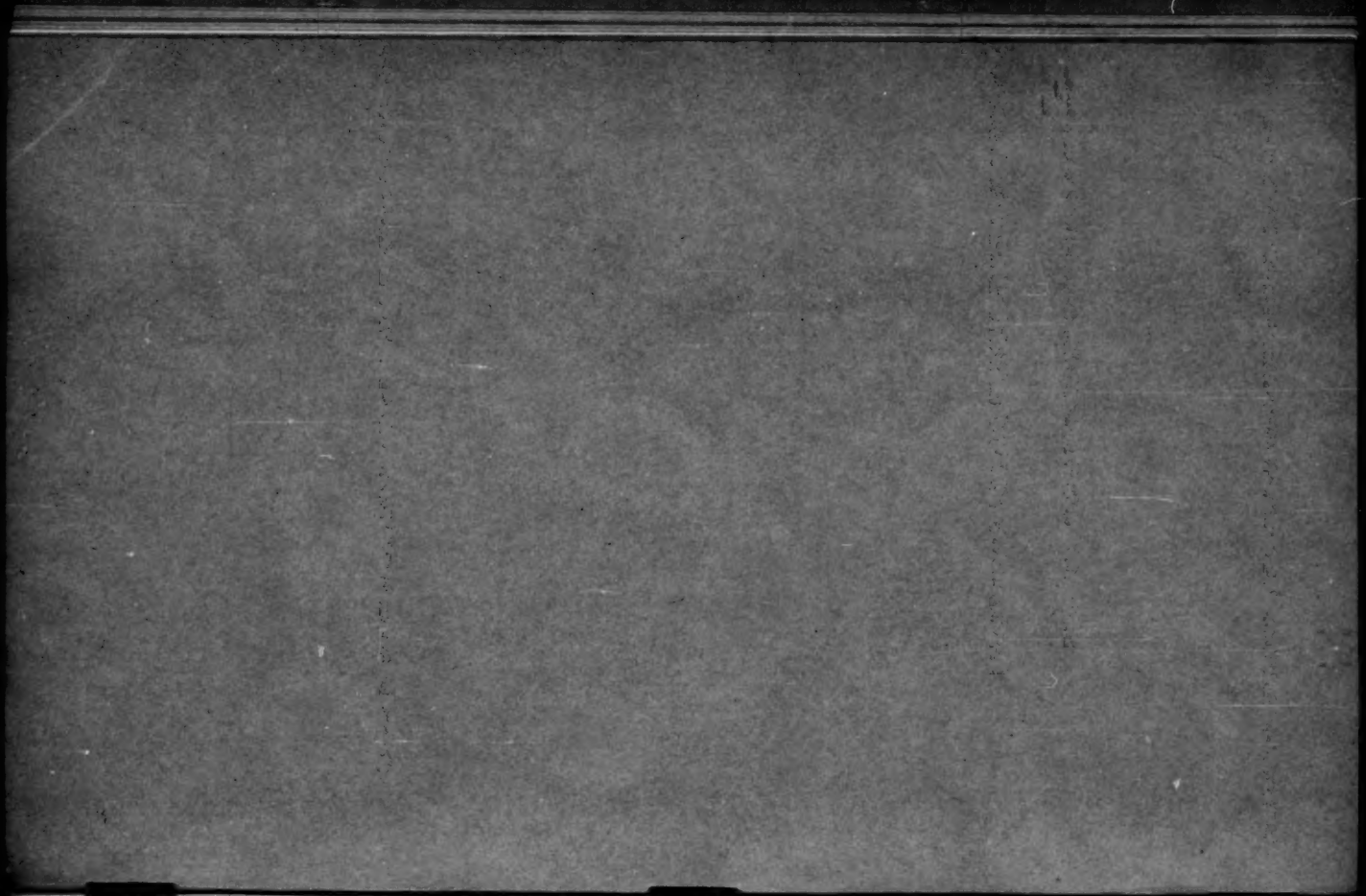
Show the difference in application to the product:

A. When the rate is based on total actual payroll.
B. When it is based on normal payroll—i.e., when it is applied as a stated per cent of each dollar of payroll.

Solution:

	Payroll	Case A. Burden	Case B. Burden
Dept. 1.....	$ 4,000	$ 2,000	$1,000
Dept. 2.....	2,000	1,000	500
Dept. 3.....	9,000	4,500	2,250
Dept. 4.....	5,000	2,500	1,250
Totals	$20,000	$10,000	$5,000

Comment. In Case A. Department 3 gets $4,500.00, as its portion of "General Manufacturing Expense," yet that Department is operating on a normal basis. This is an unfair distribution. In Case B., Department burdens are not distorted, and the "General Manufacturing Expense" shows an unabsorbed balance of $5,000. This is the true condition, because if all departments were operating at normal capacity all the expense would have been absorbed.

Summary

To sum up, probably all cost accountants thoroughly realize the seriousness of present-day low volume operating conditions. Normal overhead rates—or in some cases somewhere between actual and normal—are probably being used in making estimates. This paper proposes a proper and equitable distribution of general factory overhead and suggests a basis for quoting prices that will make a satisfactory market for the company's product. It was this main idea which the authors have had in mind.